

The National Energy Technology Laboratory



Keynote Address

**University Coal Research/
Historically Black Colleges and Universities
and Other Minority Institutions
Contractors Review Meeting**

**Arthur L. Baldwin
Regional Manager**

**June 5, 2001
Marriott City Center
Pittsburgh, PA**



Welcome



Presentation Outline

- **Why Energy is Important**
- **Energy, Today and Future**
- **NETL**
- **NETL's Role**
- **Partnerships**



Energy Affects Everyone



Reliable power for air traffic control, banking and telecommunications



\$1,900 per person per year spent on energy



Fuel warms our homes and provides electric to wash our clothes and power our televisions



Energy needed to produce food and deliver clean water to our homes



Fuel provides mobility



Energy Production and Use Impacts U.S. Economy and Environment



Burgers ~~99¢~~ \$1.09

Prices

Energy prices impact all economic sectors - we spend 7% of GDP directly on energy



Employment

No energy - no jobs



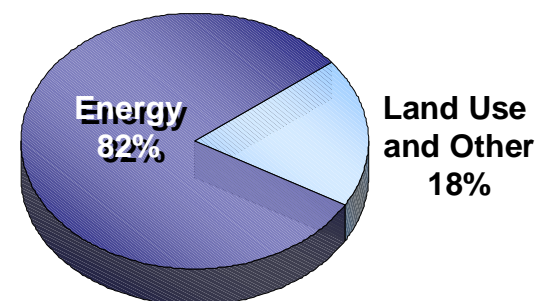
Land use

Energy is a major land user



Air Emissions

Emissions down but continuing pressure to reduce further



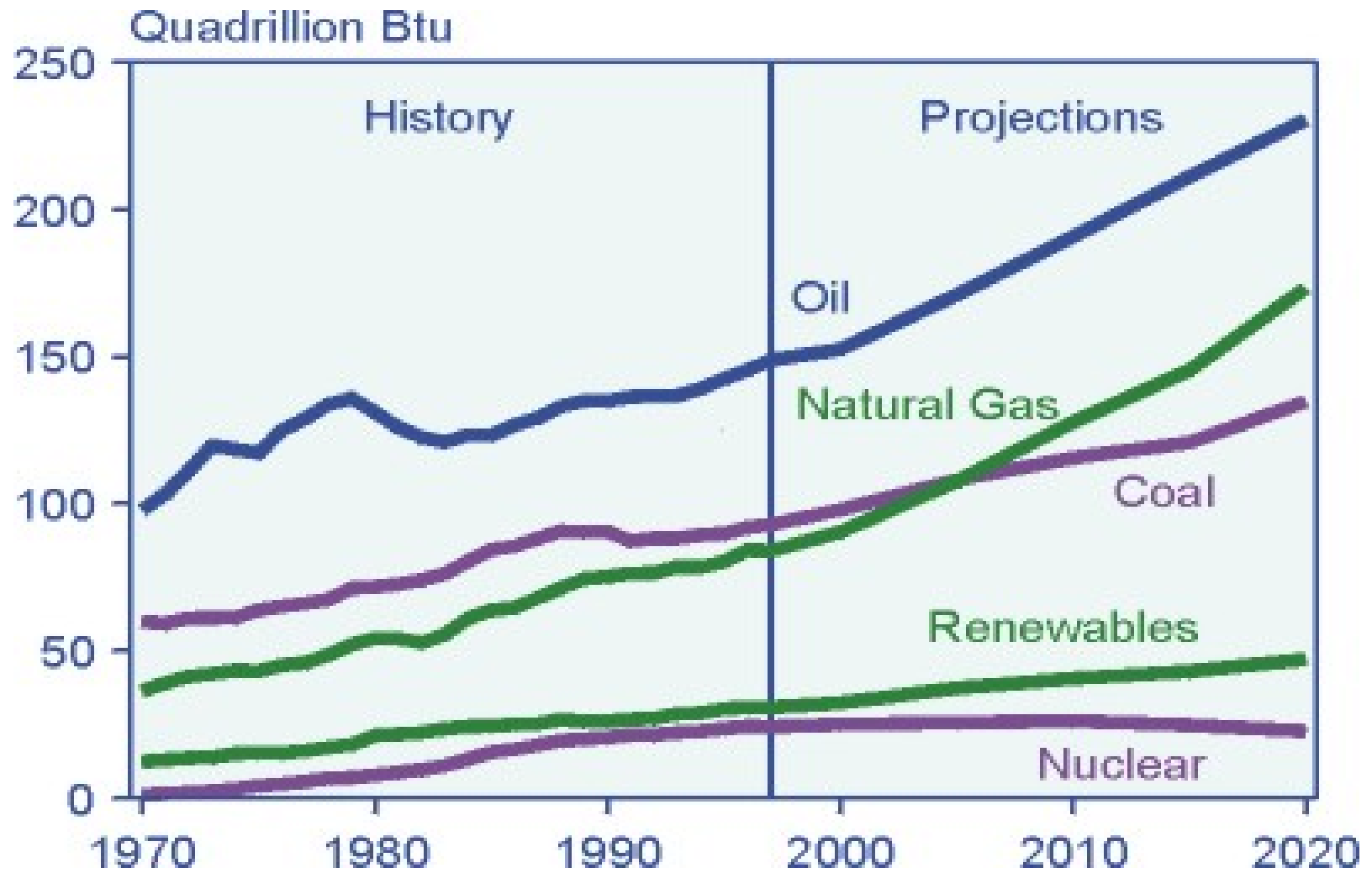
Greenhouse Gas Emissions

Energy responsible for 82% CO₂ equivalent emissions

Source: EIA Report #EIA/DOE-0573 (98)
"Emissions of Greenhouse Gases in the U.S.: 1998
Executive Summary" (Nov. 99)



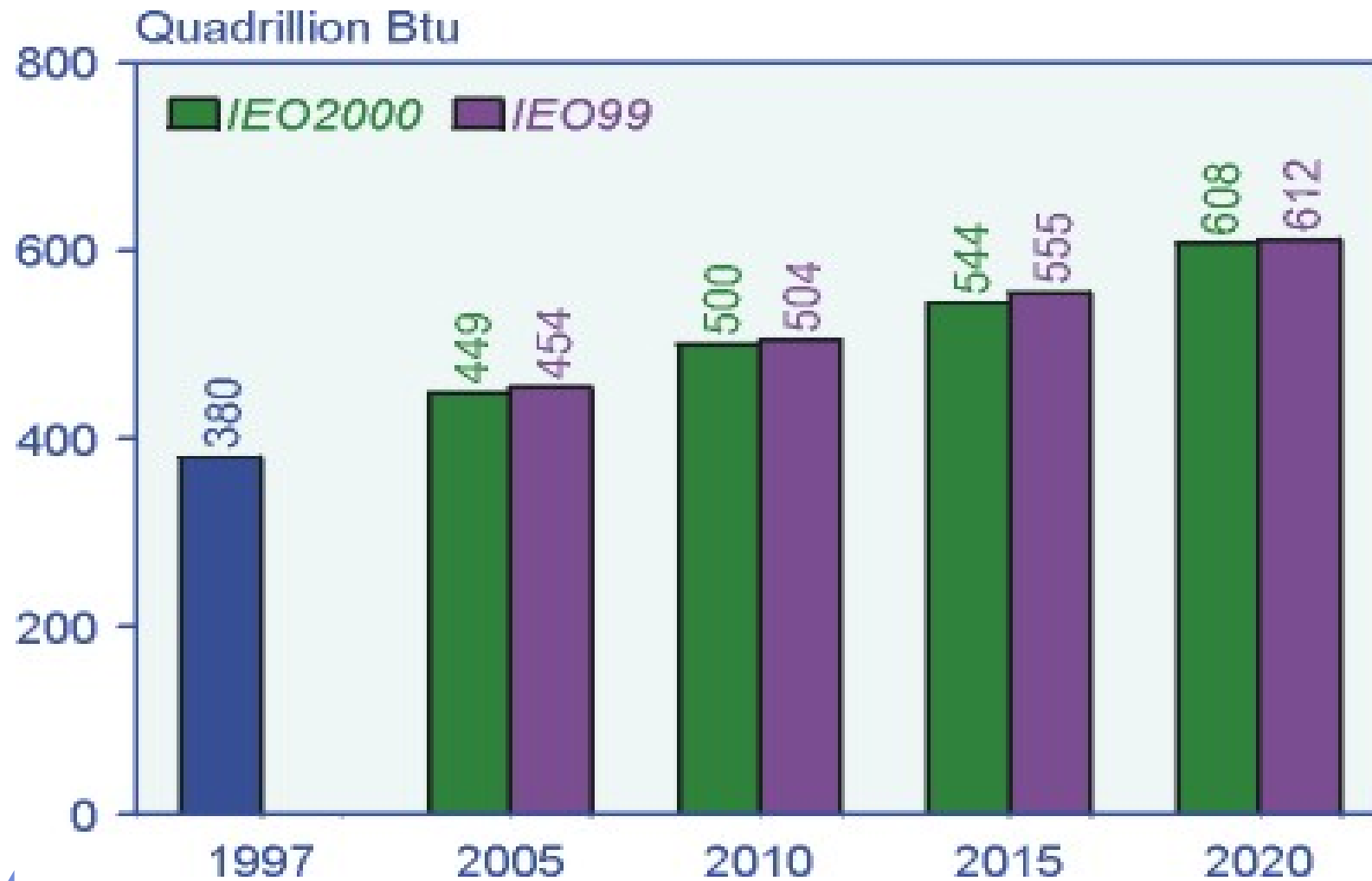
World Energy Production



Source: US - EIA



World Energy Consumption



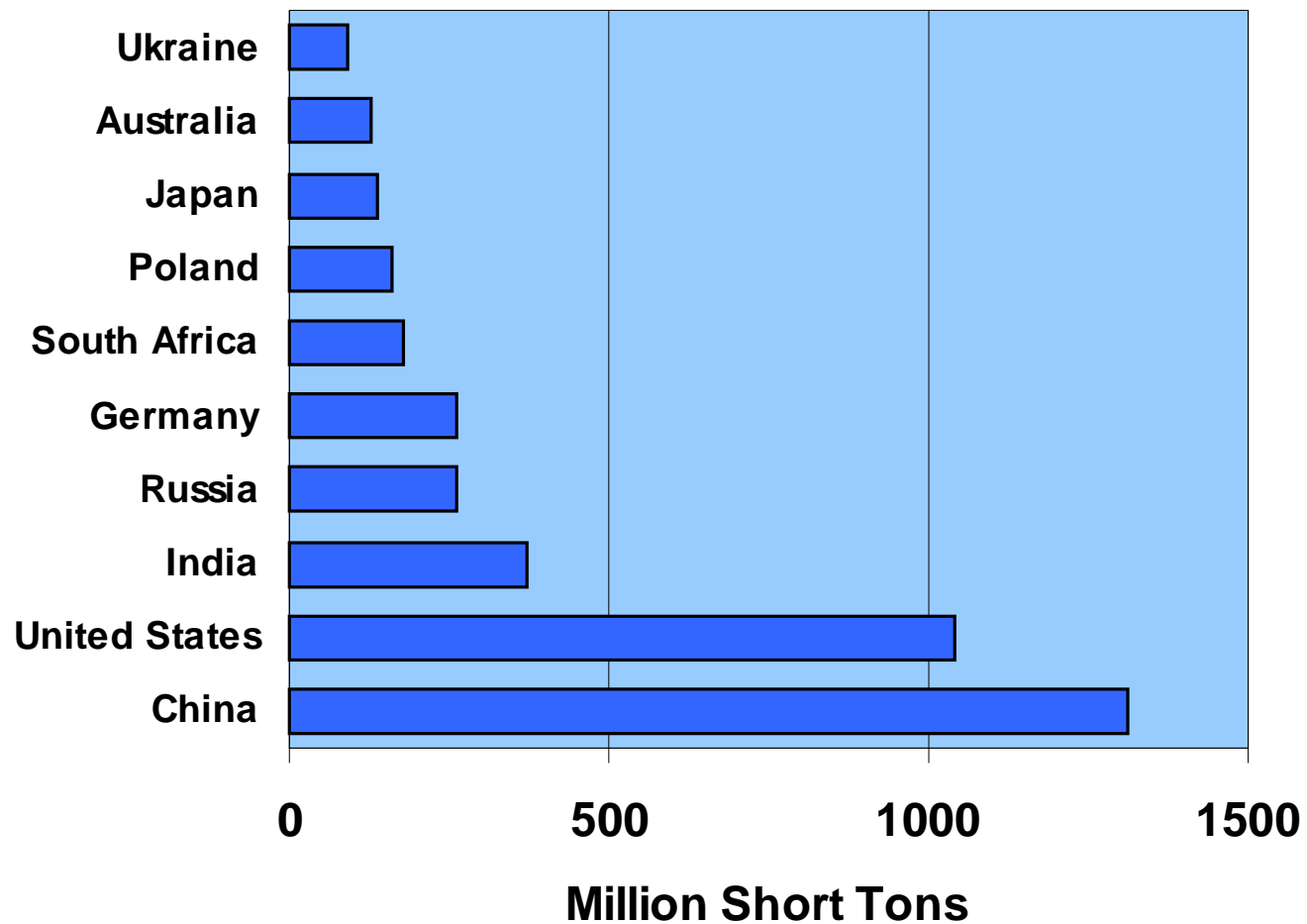
Source: US - EIA



World Coal Consumption



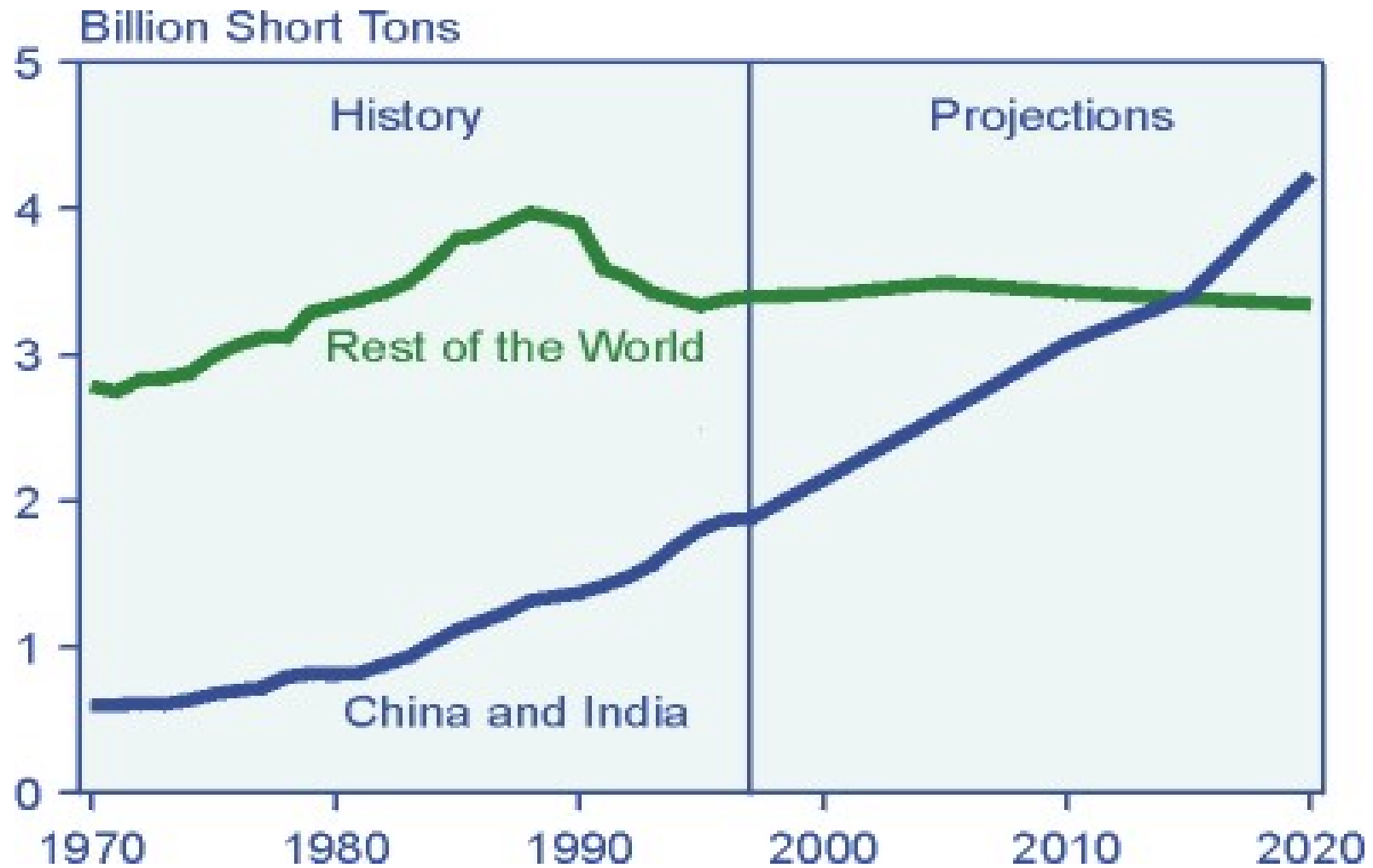
Coal Consumption By Country, 1998



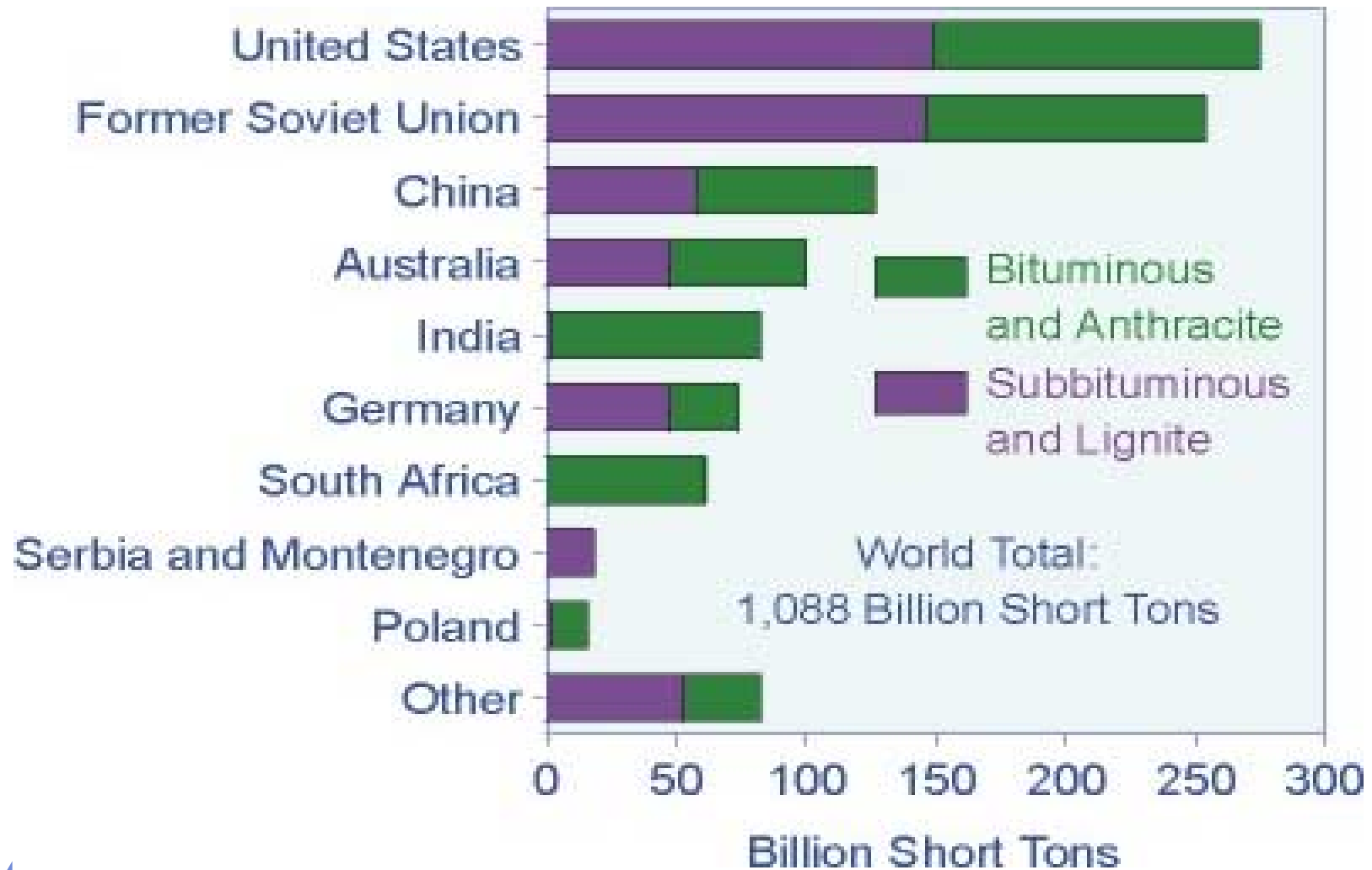
Source: US - EIA's IEO



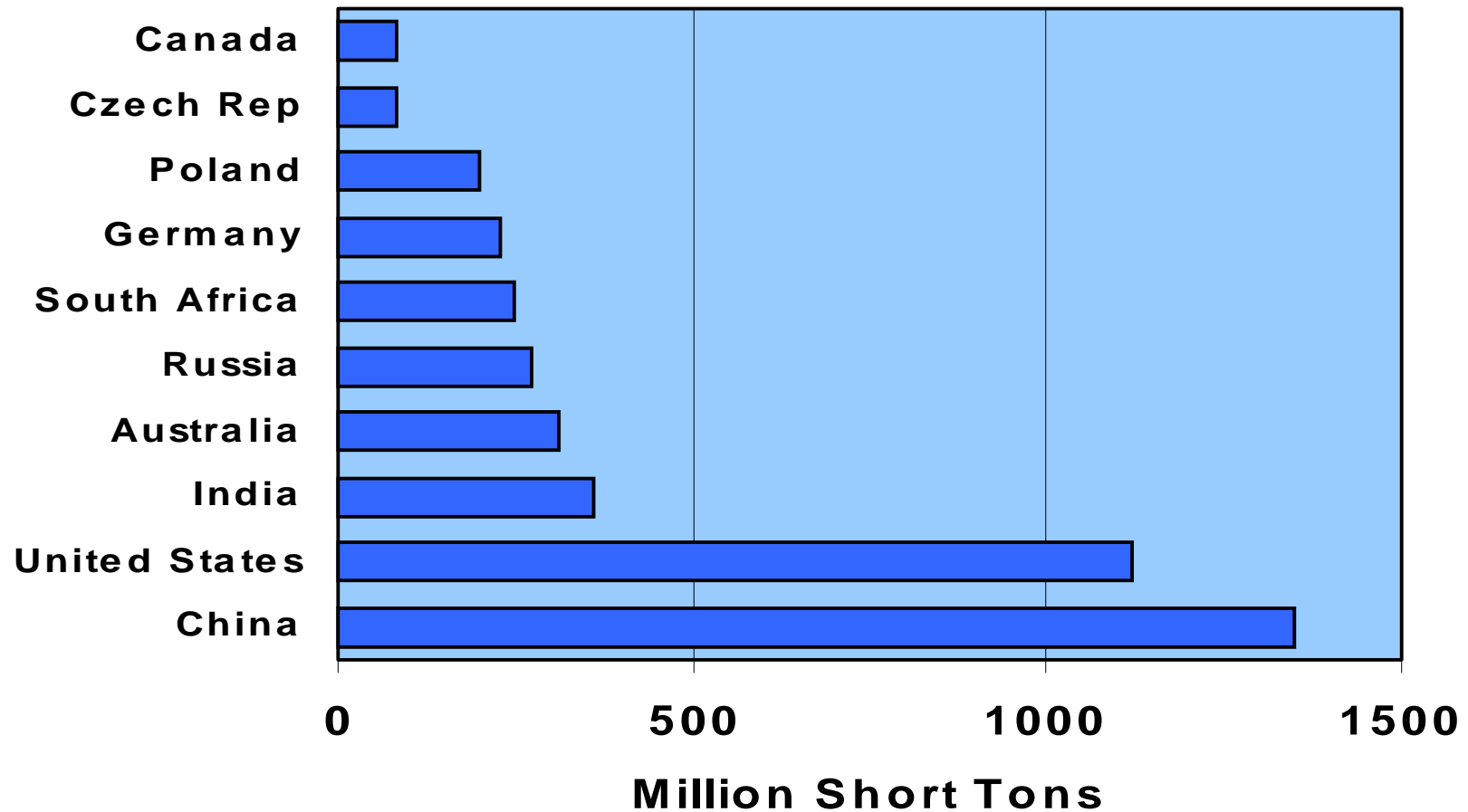
Global Changes in Coal Consumption



World Recoverable Coal Reserves



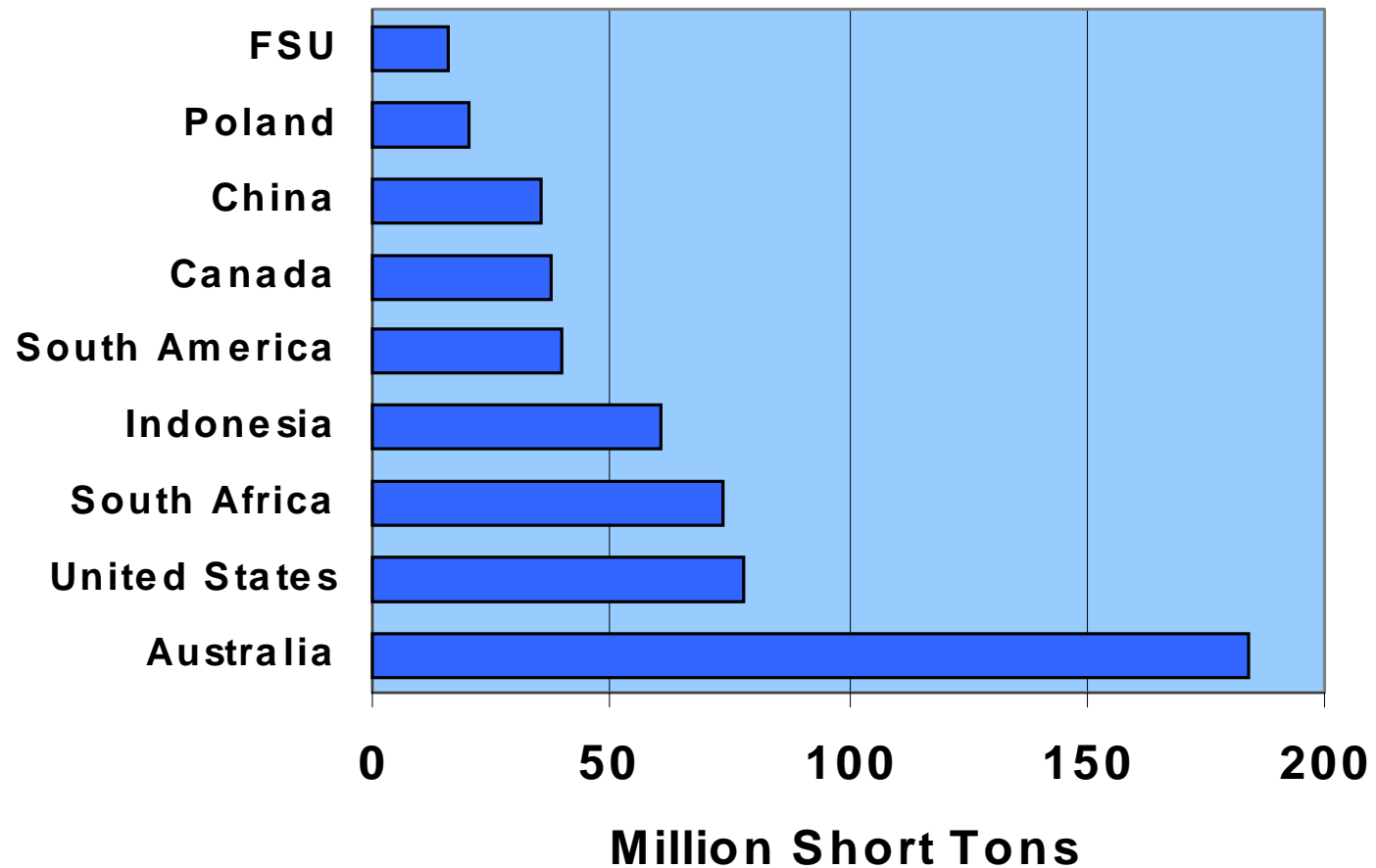
World Coal Production, 1998



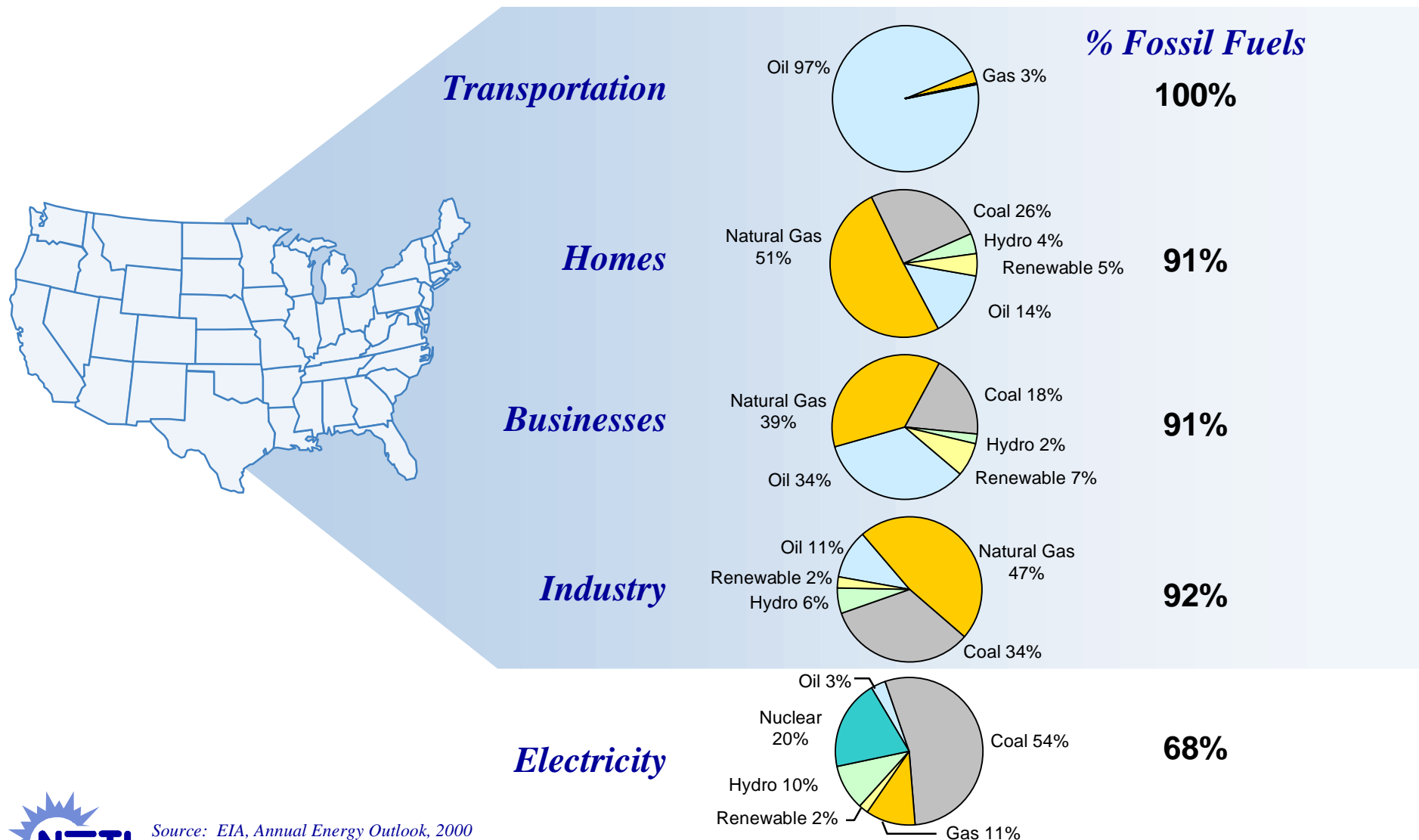
*Source: US - EIA's
IEO*



World Coal Exports, 1998



Fossil Fuels Provide 85% of Our Energy



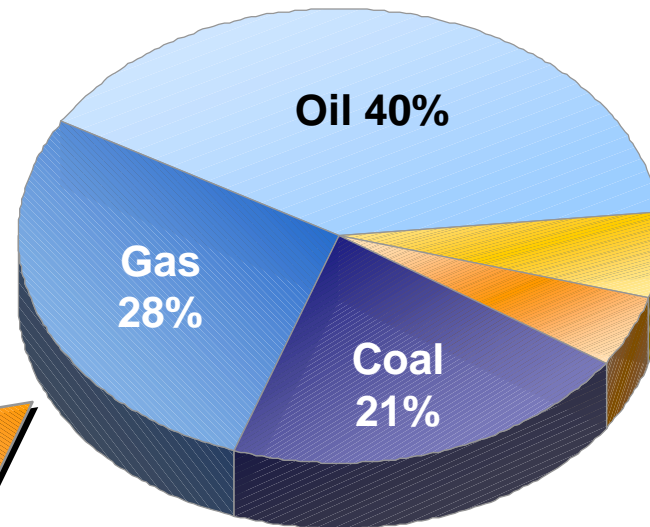
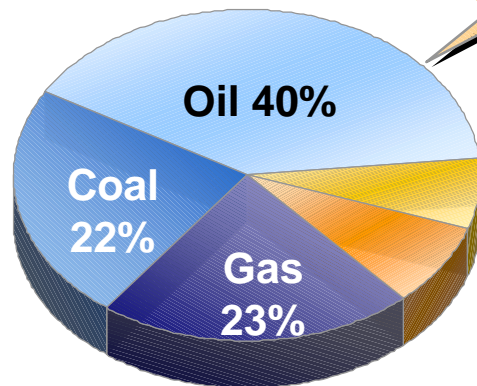
Source: EIA, Annual Energy Outlook, 2000

Fossil Energy: America's Energy Foundation

1999

96.1 Quads

Fossil fuels provide 85% of energy (67% of electricity)



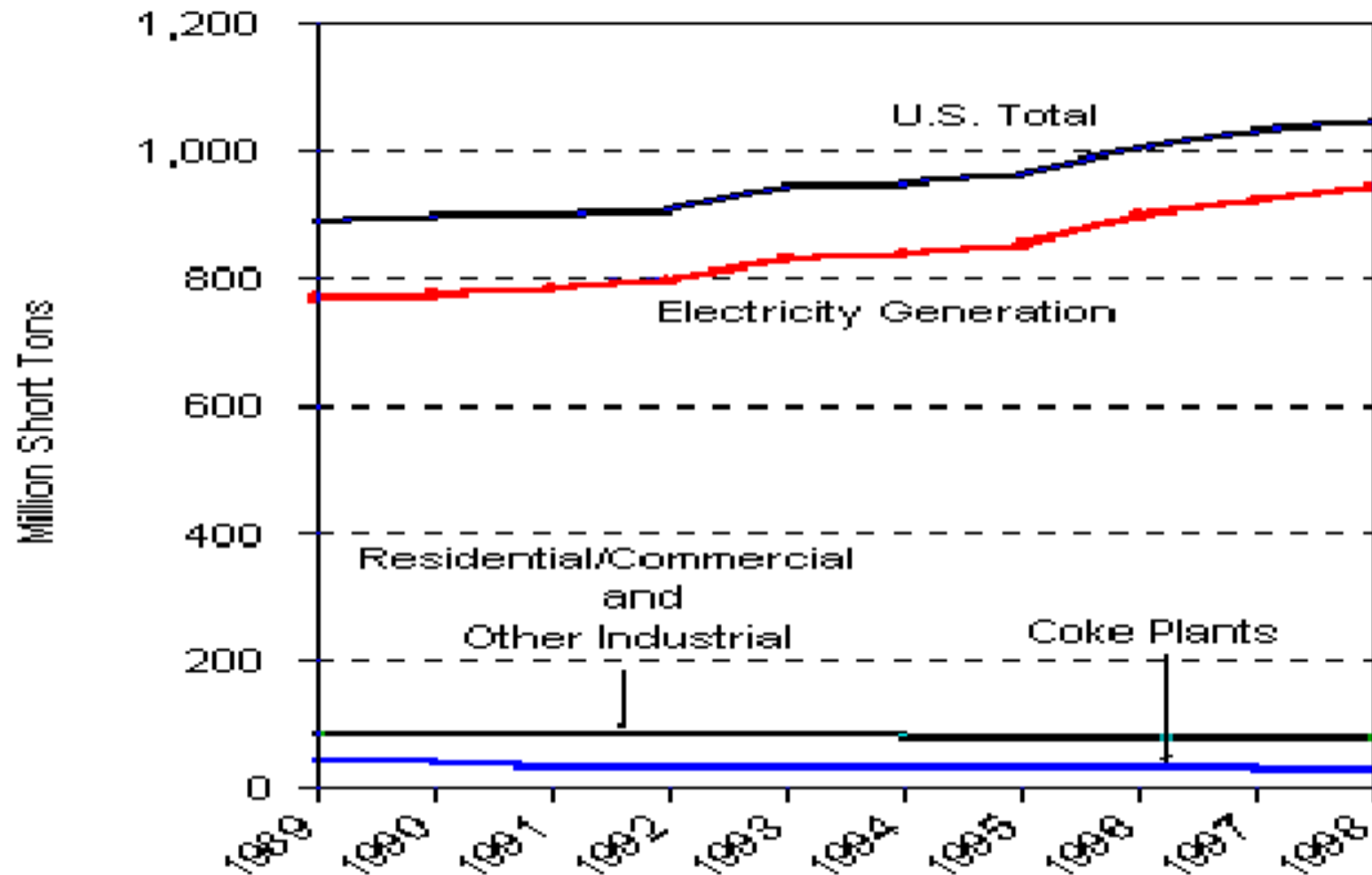
2020

127.0 Quads

By 2020, reliance on fossil fuels could grow to 90%



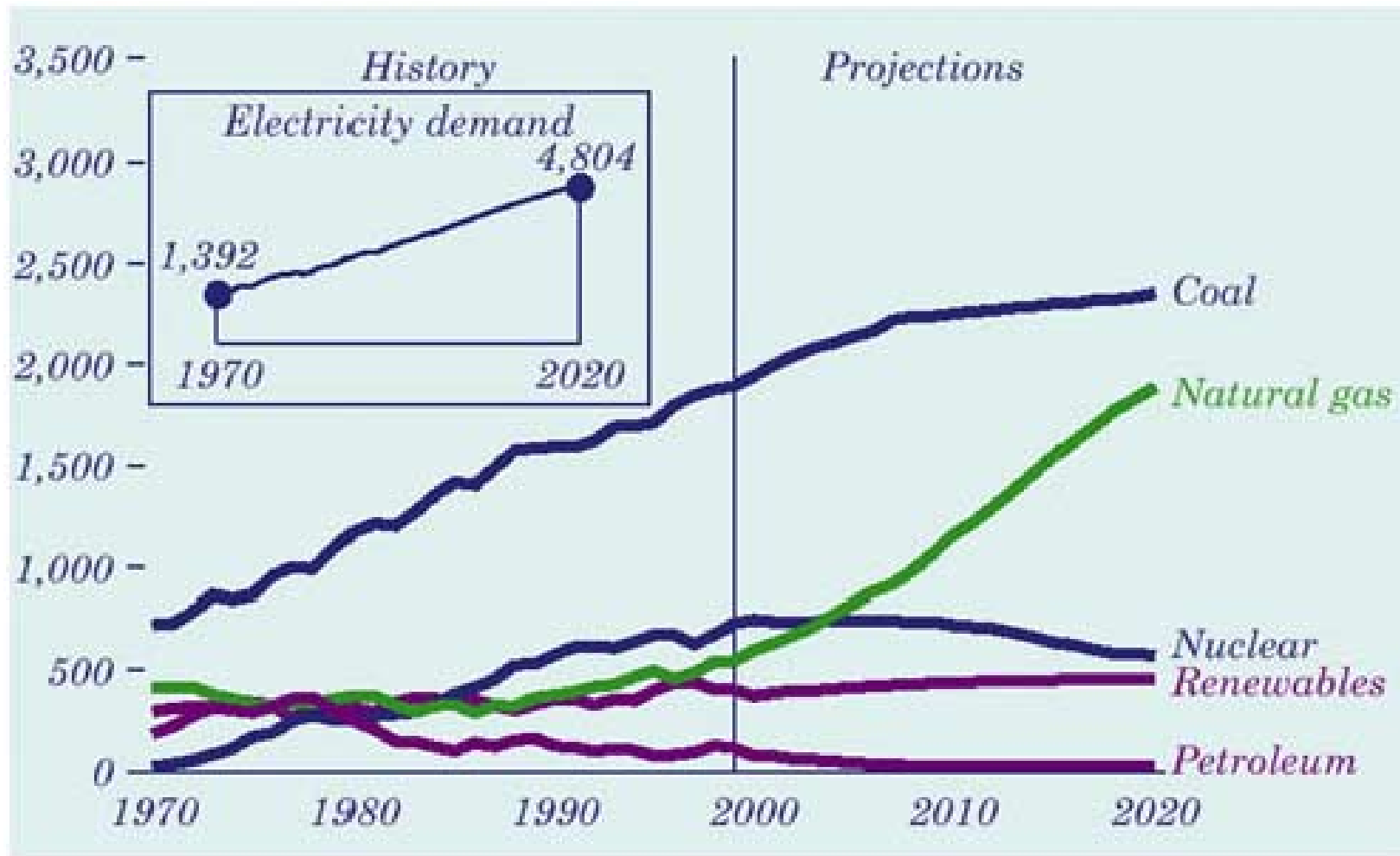
U.S. Coal Consumption Sectors



Source: US -
EIA



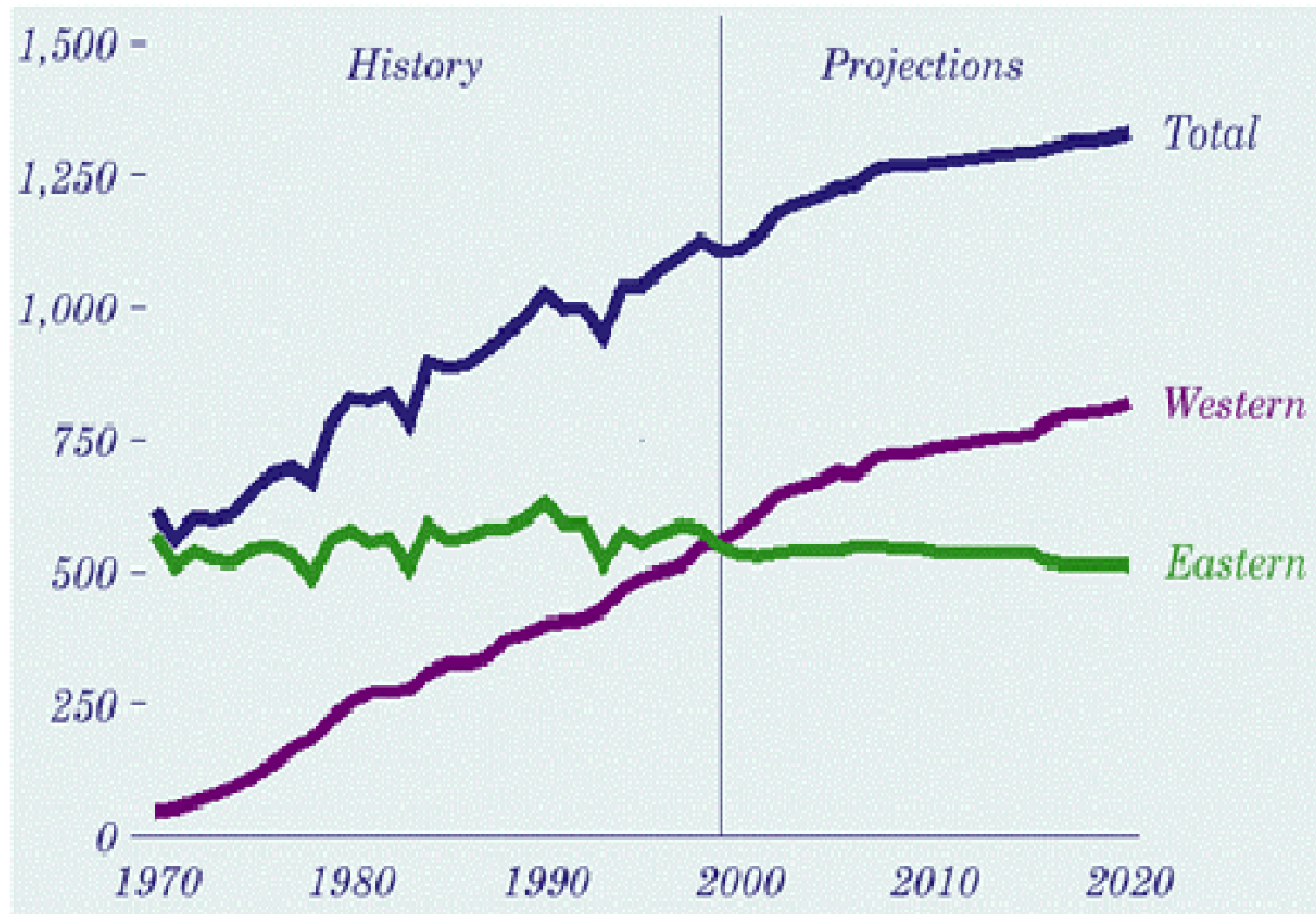
Change in U.S. Fuel Use Trends for Power Production



Source: US -
EIA



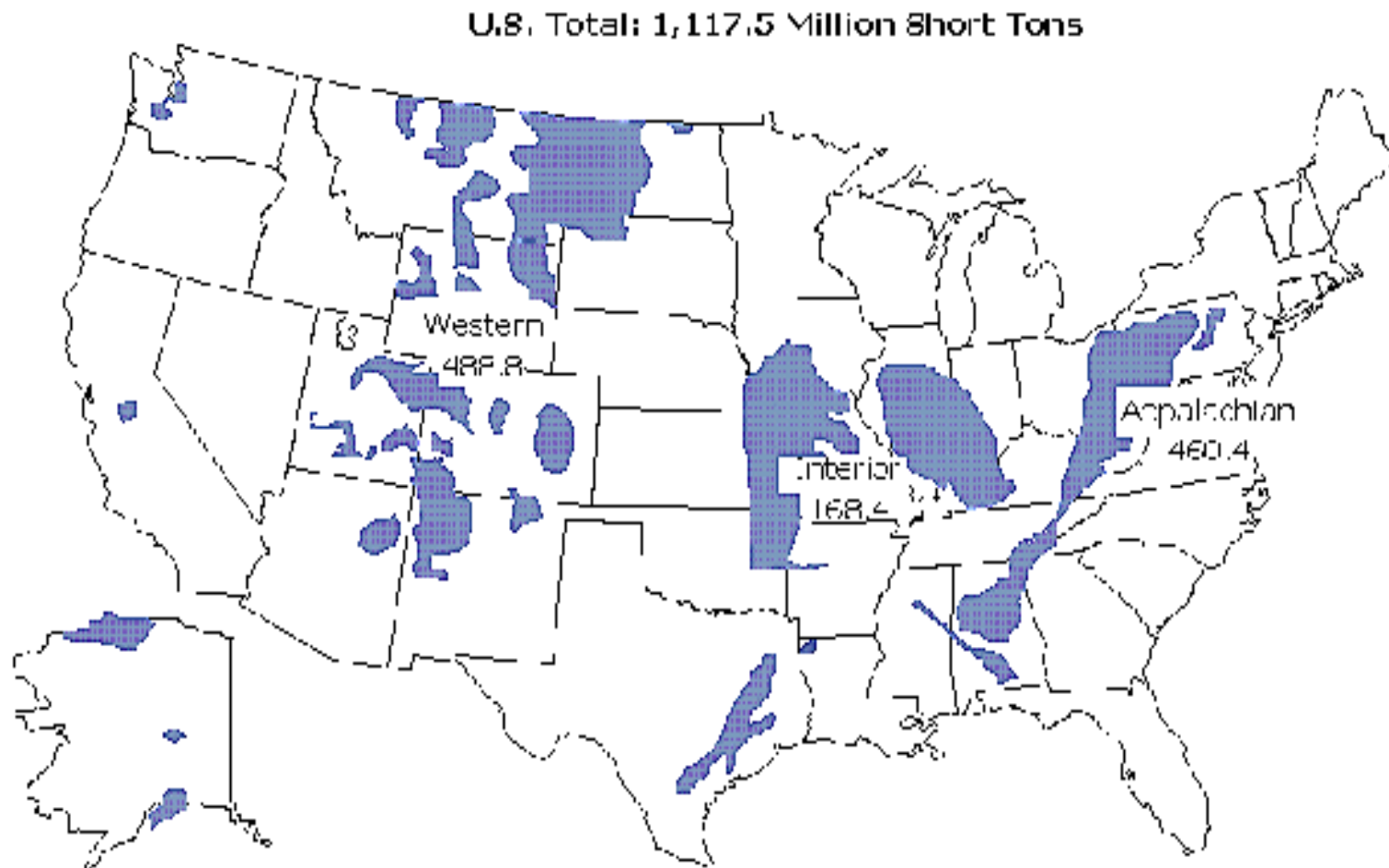
U.S. Coal Production Trends



Source: US - EIA

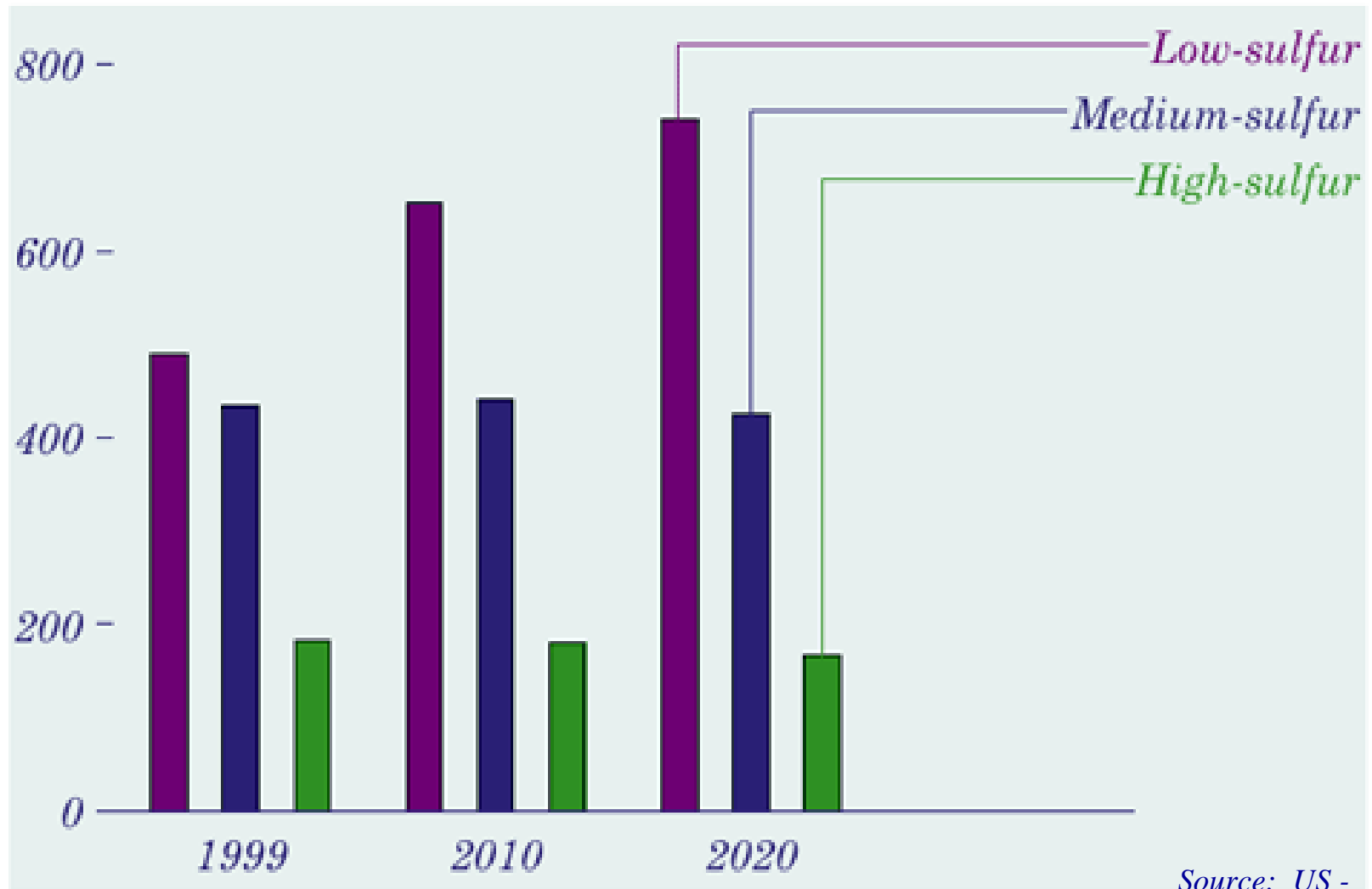


Geographic Distribution of U.S. Coal Mining



Source: US - EIA

Static/Decreasing Demand for Eastern Coal



Source: US -
EIA

Obstacles Facing Eastern U.S. Coal Production

- Increasing environmental regulations.
- Changes in fuel use trends for electric power production.
- High production costs relative to western coal.
- Depletion of high quality coal reserves.
- Increased mining costs owing to tightening legislation.



Tightening Environmental Regulations Against Coal-Fired Power Plants



1998-2000

2002-2004

2005-2007

2008-2012

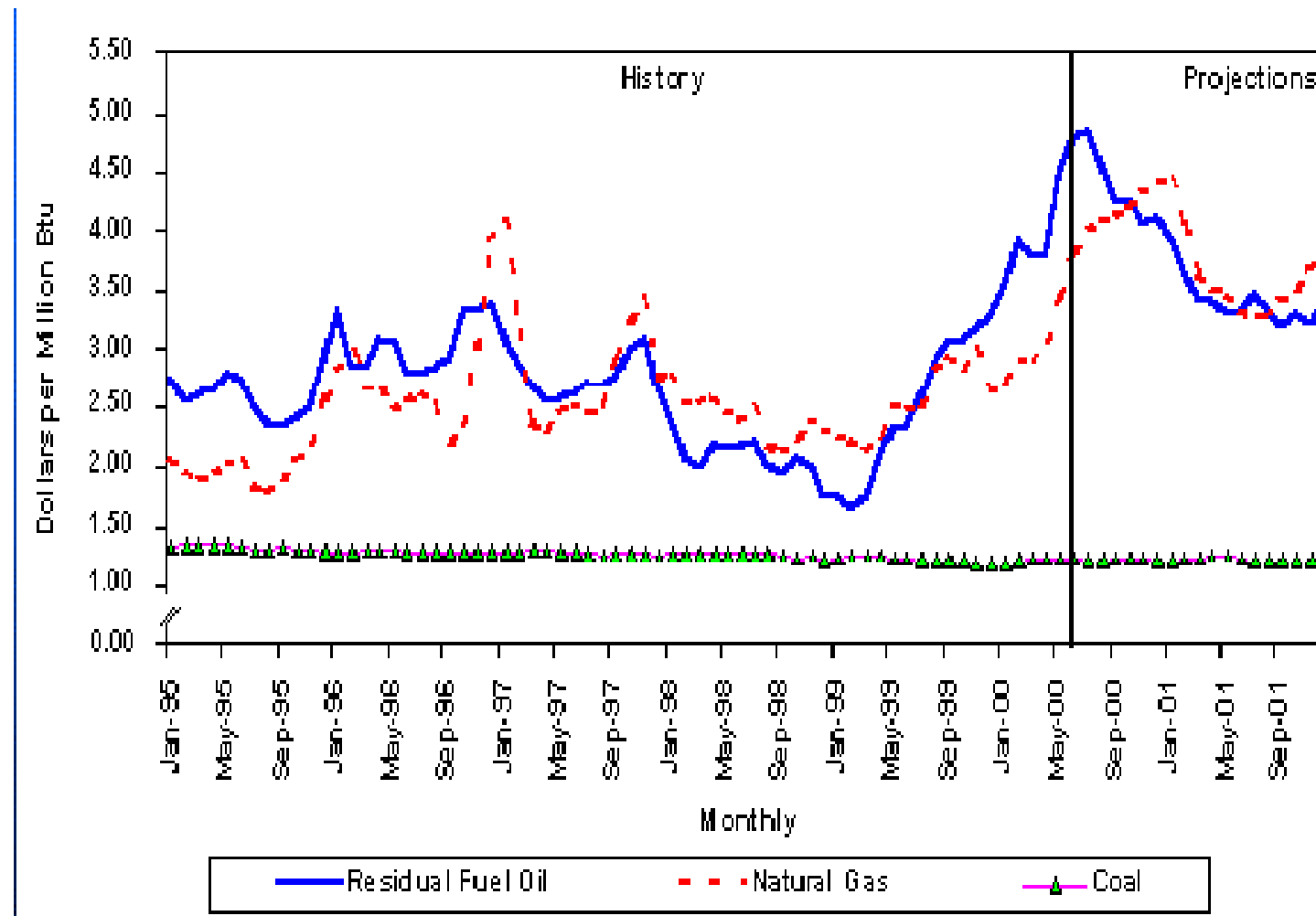
2013-2017

Year

Source: Southern Company, Inc.



U.S. Fuel Price Trends -- Coal, Oil, and Gas



Source: US - EIA



National Energy Issues

The three most significant and immediate fossil energy issues facing the United States are:

≡ ***Electricity Supply
and Reliability***



≡ ***Natural Gas Supply
and Deliverability***



≡ ***Clean Liquid
Fuels***



Coal and Electricity

Electric Reliability Becoming a National Problem



- Demand has grown but few new plants built
- >90% of planned plants are gas-fired
- Clean distributed generation promising but not commercially available
- Continued pressure to reduce environmental emissions

Loss of Fuel Diversity May Not Be in Nation's Best Interest



Natural Gas Production and End Use

Era of “Cheap” Gas May Be Over

- Gas prices spiked to 10 times the price 2 years ago
- Four-year backlog of orders for new gas turbine power plants
- Gas and electric increasingly intertwined
- Concerns over gas deliverability
- Rapid decline curves for new wells



Clean Liquid Fuels

Influence of OPEC Rises

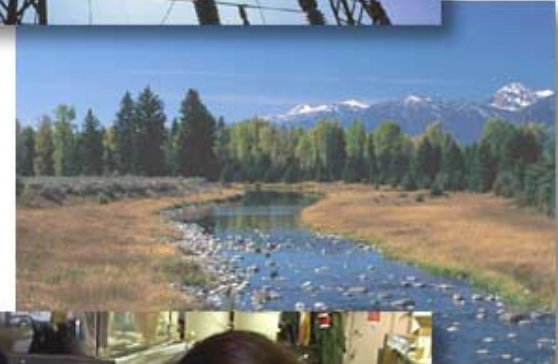
- **Imports rising**
- **EPA's new stringent specs for gasoline and diesel fuels stress refineries**
- **Proliferation of fuel specs may compromise reliability**
- **High-efficiency vehicles of future require improved fuels**



What Does All This Mean?

Three Forces Will Shape Energy Industry

- Market forces
- Environmental movement
- Technology innovation



What Role Will the National Energy Technology Laboratory Play?



The Role of Government in Energy RD&D

- **It's not about controlling price – it's about:**
 - Human health: Improving air emissions
 - Environment: Improving water and land impacts
 - Safety: Improving reliability of energy technologies
 - National security: Improving independence from foreign fuels
- **It's about accelerating improvements today and preparing for tomorrow**



National Energy Technology Laboratory

National Focal Point for Fossil Energy RD&D Programs



Pittsburgh PA

*One of the
U.S. Department of Energy's
15 National Laboratories*

NETL



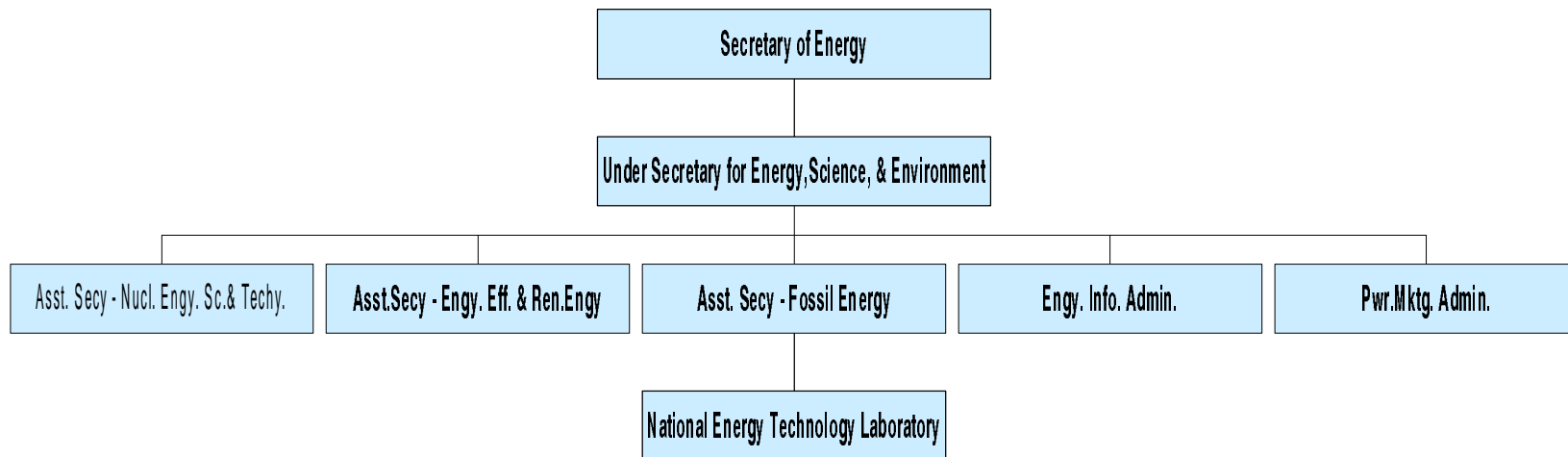
Tulsa, OK



Morgantown WV



Relationship of NETL to DOE



National Energy Technology Laboratory

- Formerly the Federal Energy Technology Center
- Part of the National Research Community for over 50 years
- FY2001 Budget of \$732.7 Million

■ Over 1,100 research activities in all 50 states and more than 20 countries

- Private Industry
- Universities/Colleges
- Not-for-profit laboratories
- Other DOE National Laboratories
- Other Government Laboratories

■ Homesites in Morgantown, WV, Pittsburgh, PA, and Tulsa, OK

- 68 Buildings
- 818,000 Square Feet
- 24 Major On-Site Research Facilities

■ 550 Federal Employees

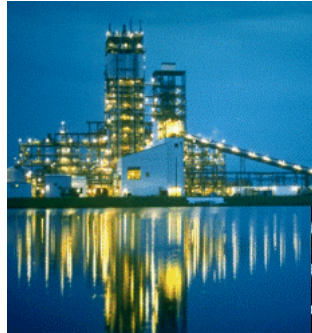
- Technical Management
- In-House R&D
- Administration
- E&E Technical & Business Services

■ 608 Support Contractors

- 480 On-Site
- 128 Off-Site



NETL



What We Are

- One of DOE's 15 National Laboratories
- Government Owned and Operated

What We Do

- Shape, fund, and manage extramural RD&D programs
- Conduct on-site science and technology research
- Conduct analyses to support policy development and best management and business practices

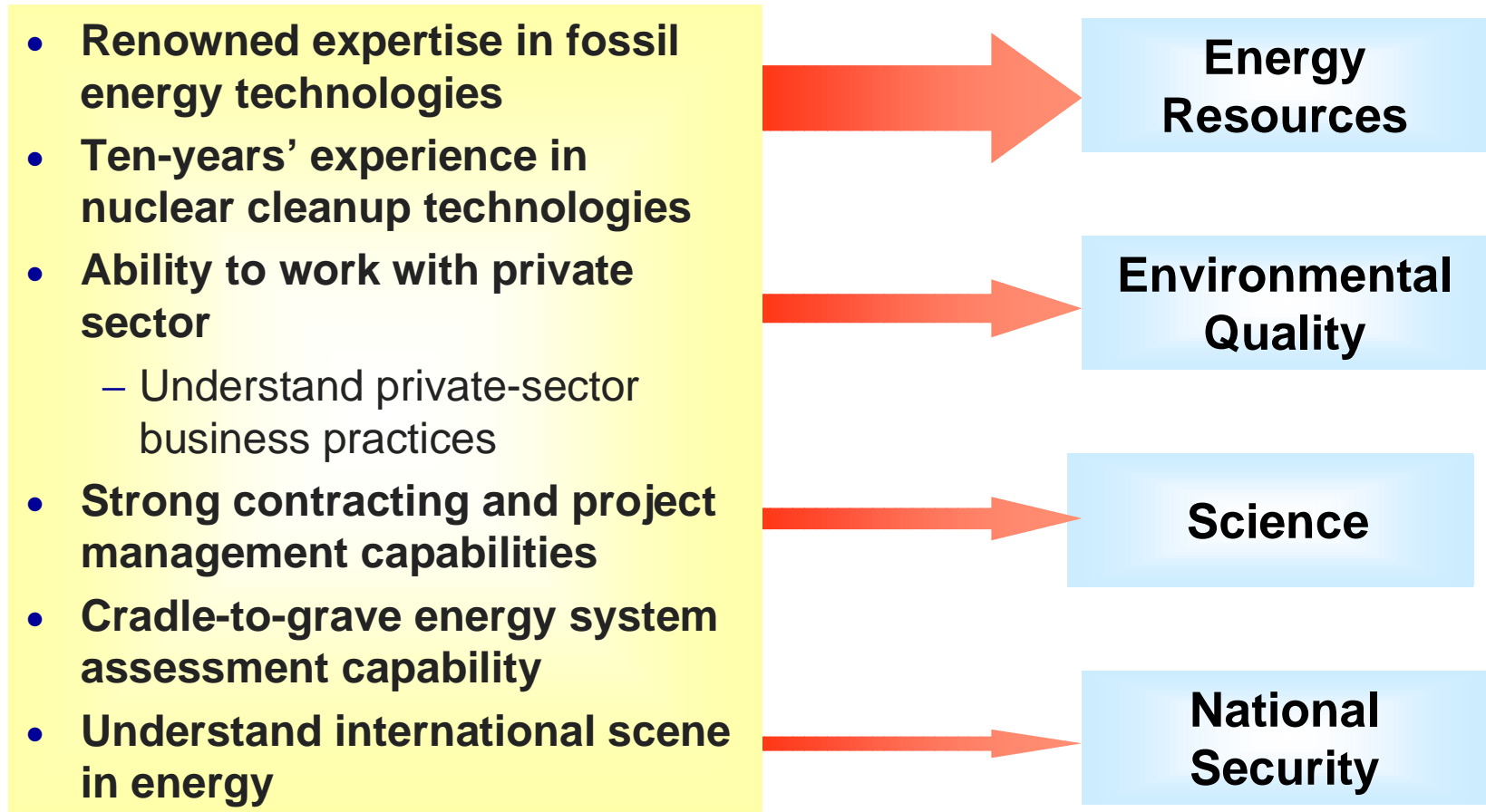


Our Mission

- **Resolve the environmental, supply, and reliability constraints of producing and using fossil resources to provide Americans with a stronger economy, healthier environment, and more secure future**
- **Support development and deployment of environmental technologies that reduce the cost and risk of remediating DOE's weapons complex**
- **Contribute to best business practices and energy policy development**



Our Capabilities Support DOE Missions



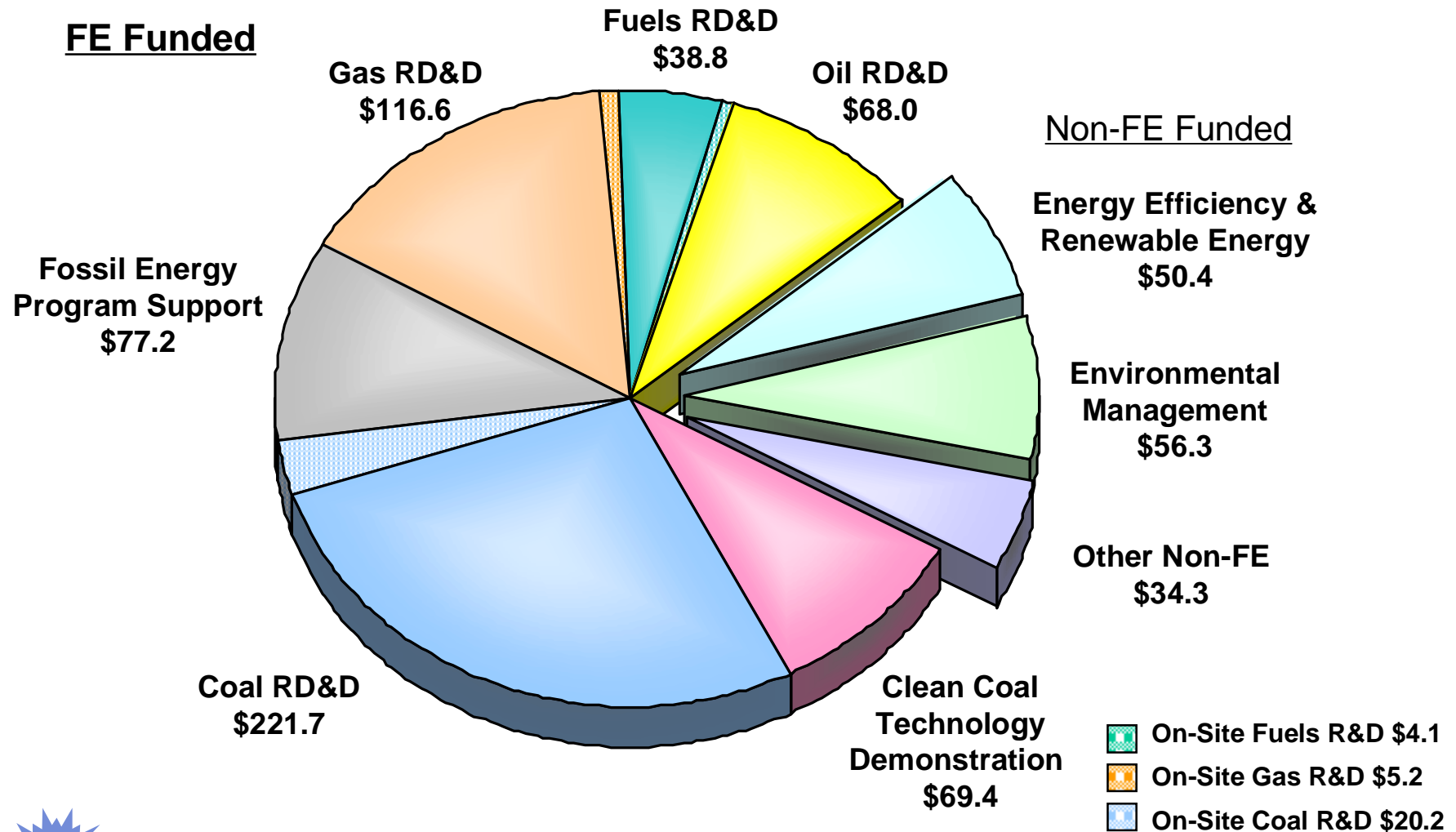
Sec. Richardson's National Laboratory Designation December 1999

“Today, 85 percent of our country’s energy comes from fossil fuels. 90 percent of world’s energy demand is met by these fuels. And that is not going to change overnight. By 2020, the world’s appetite for energy is likely to be twice what it was in 1990. And most of that appetite will still be fed by fossil fuels.

Because of the important work you do, I want you to have the full status of a National Lab - the full rank and prestige. I want the world to know that this is the place to come to see what is on the horizon for fossil energy technology.”



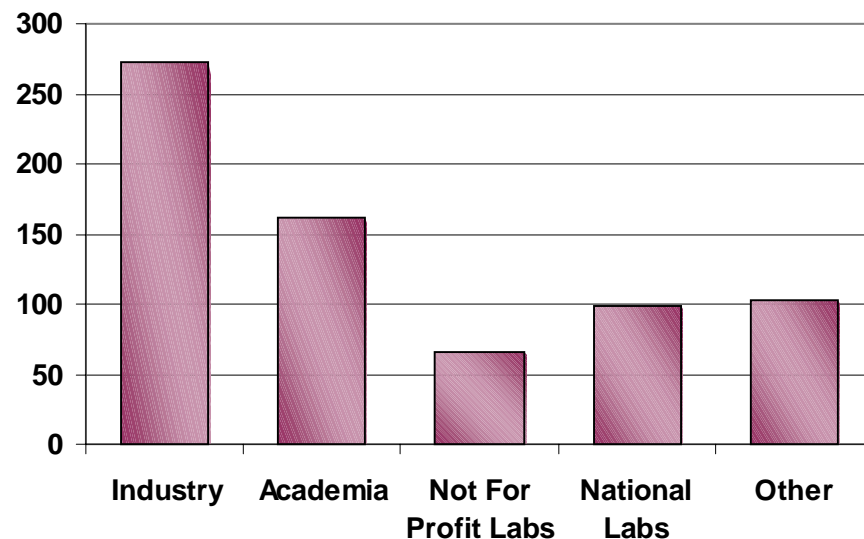
NETL FY01 Budget (\$732.7 Million)



Shape, Fund, and Manage Extramural RD&D

- Over 1,100 research activities in all 50 states and 16 countries
- Total award value of \$7.3 billion
- Private sector cost sharing of \$3.9 billion
 - Leverages DOE funding
 - Ensures relevance
 - Mission accomplishment only through commercialization
- 55 active MOU's and MOA's

Projects by Performer Group



Conduct On-Site Science and Technology Research

- **Four Focus Areas** and two technology clusters
- Involves 1/3 of staff
- 31 CRADA's
- Research laboratories at Morgantown and Pittsburgh

Carbon Sequestration Science

Large stationary sources of CO₂



Ultra-Clean Fuels

For high-efficiency transportation systems



Gas Energy Systems Dynamics

Gaseous-fueled power generation systems



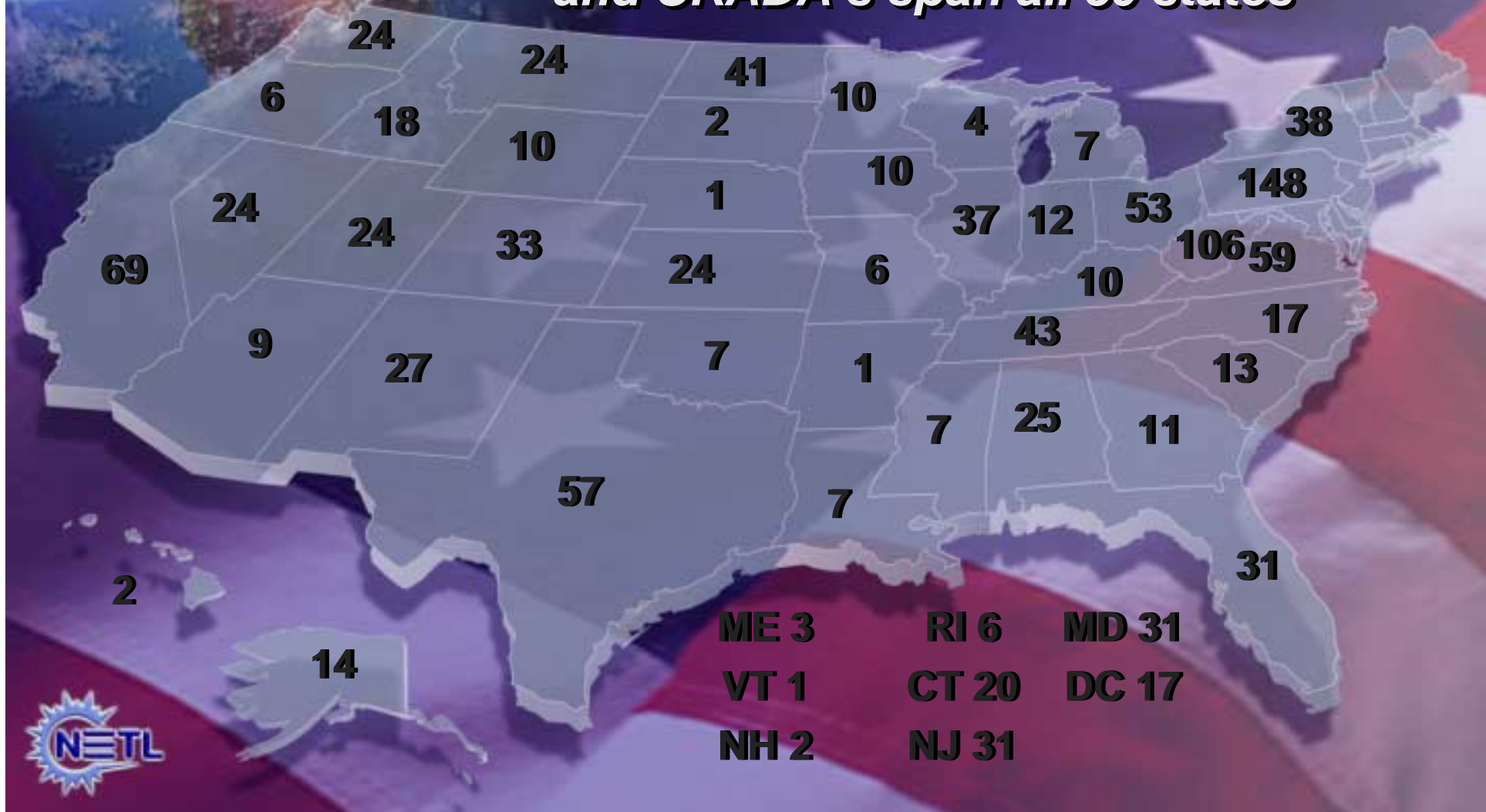
Computational Energy Science

Virtual demonstrations of energy plants of future



NETL's National Role

***NETL's over 1,100 research activities
and CRADA's span all 50 states***



NETL's Five RD&D Areas

**Electric Power
Using Coal**
Mining to Light Switch



**Energy
Policy Support**
*A Key Issue in Use
of Fossil Energy*



**Strategic Center
for Natural Gas**
Borehole to Burner Tip



Clean Fuels

**Oil Supply
NPTO**



**Fuels from
Coal and Gas**
*Supply and Delivery of Clean
Fuels for Transportation/
Other End Use
Sectors*



**Environmental
Management/Defense
Programs**
Supporting DOE



Strategic Center for Natural Gas

Well-Bore to Burner-Tip

- **Next Generation Gas Turbines for Large Industries / Utilities**

- Flexible 30-300 MW turbine systems
- Ramgen Engine
- Intercooled aero systems

- **Gas Infrastructure Reliability**

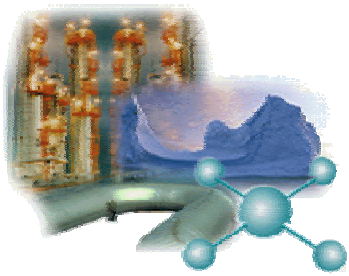
- Enhance pipeline system reliability
- Increase gas deliverability
- Increase operational flexibility of gas storage facilities

- **Distributed Generation**

- PAFC - entering commercial market
- MCFC - high efficiency
- SOFC/SECA - low cost
- Hybrid turbine/fuel cell - ultimate efficiency
- RECIP Engine - lowest cost

- **Gas Exploration & Production**

- Resource and reserve assessments
- Improved drilling and completion technologies for low-perm/deep gas
- Gas hydrates and deep gas



Environmental Management

Supporting the DOE Complex

- **Environmental Management: Reducing Cost and Risk of Remediating DOE's Weapons Complex**
 - Decontamination & decommissioning focus area
 - Industry and university program
 - Civilian power plants



- **Technical & Business Services for DOE**
 - Center for Acquisition & Business Excellence
 - Corporate Human Resource Information System

- **Defense Programs**
 - Support tritium production



Global Climate Change

The Key Issue in Use of Fossil Energy



- **Climate Change Support**

- Understand tradeoffs to guide RD&D program development
- Policy support for co-control of GHGs and criteria pollutants
- Contribute to resolution of issues

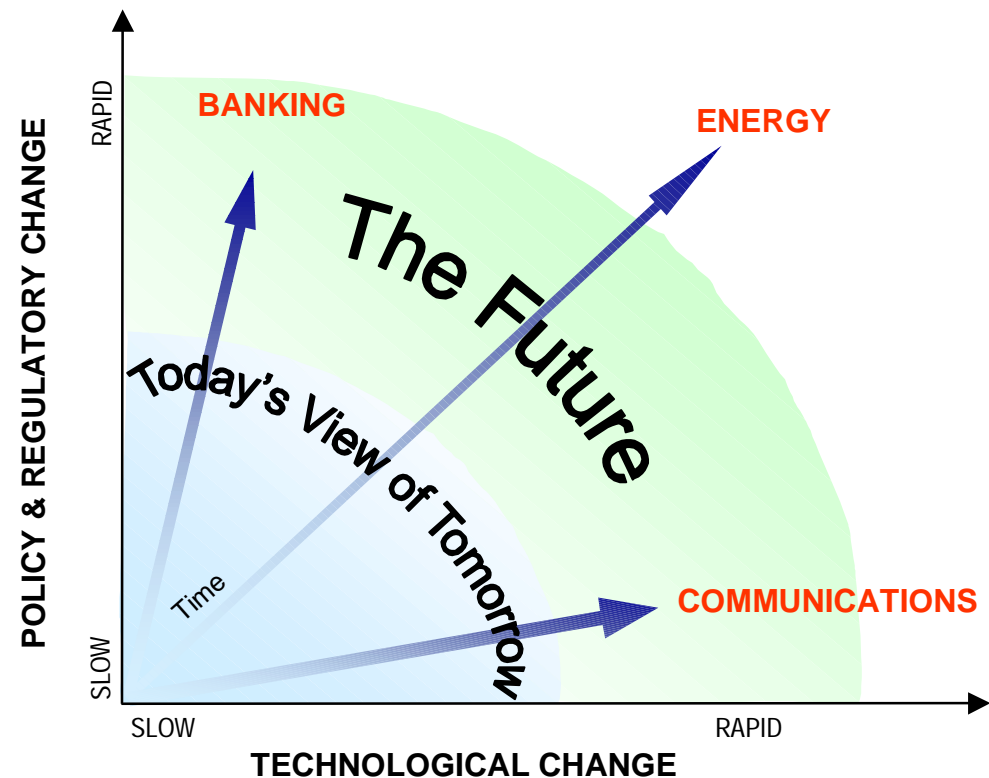
- **International Projects: A Critical Element in Addressing Climate Change**

- Projects in 16 countries
- Emphasis on developing economies particularly China, India, Latin America
- Promote use of advanced technology from NETL portfolio



Support Policy Development

- Conduct analyses that anticipate and support policy development
- Create “knowledge products” giving policy makers technical information in useful format



**Changes in energy industry
driven by both technological
and policy/regulatory change**

Transportation Fuels Program

Commercial and Military Applications

- *Supply and Delivery of Clean Transportation Fuels*
 - *Land, Air, and Sea Applications*
 - *Policy Support and R,D&D*

- **Fossil Energy Supply:
Energy Security,
Affordability, Acceptability**

- Enhancing Domestic Resources
 - Petroleum
 - Natural Gas
 - Coal: mining (IOF) and processing
- Environmental Issues



- **Ultra-Clean Fuels for the
Existing Transportation
Infrastructure**

- Advanced petroleum processing
- Natural gas to liquids
- Coal fuels and chemicals
- Additives and lubricants



- **Delivery System Reliability**
 - Integrity of existing systems
 - Increasing complexity of products into distribution system
 - Hydrogen distribution/transportation system reliability



- **Future Fuels: New Fuel/
Transportation System
Infrastructure**

- Hydrogen
- Biofuels
- Novel fuels



Coal-Fired Power Systems

Mining to Light Switch

- **Efficiency Improvement for Next-Generation Plants**

- Clean Coal demonstrations
- Enhancements to Clean Coal plants
- Vision 21 plants with option for near-zero emissions



- **Carbon Sequestration: An Important Option to Address Climate Change**

- Low-cost capture
- Long-term storage
- Beneficial utilization

- **Mining/Water: Addressing Energy Supply Issues**

- Mining Industry of Future
- Watershed management

- **Environmental Control Technologies for Current Fleet**

- Emission control technologies for NO_x, PM_{2.5}, mercury/air toxics



Key Competencies Required To Develop and Implement National Energy R&D Programs

- ***Product Management*** to define programs and create Partnerships supportive of National policies
- ***Project Management*** to implement programs by preparing competitive solicitations, reviewing proposals, selecting the best projects, and managing contracted research efforts
- ***In-house R&D*** organization to perform research and ensure technical validity of contracted work
- ***Administration*** authorities to perform the procurement, financial, and legal functions.



Transfer NETL Supported Research and Development

Multi-State:

- Super Computing Consortium (SC²)
Partners: NETL, CMU, U. of Pitt, WVU, PSU, Duquesne University, CIC, Pittsburgh Supercomputing Center (PSC)
- Consortium for Premium Carbon Products from Coal (CPCPC)
Partners: NETL, WVU, PSU, Industry



Transfer NETL Supported Research and Development

CPCPC:

- Carbon Foam
Partners: WVU, Touchstone Research
- Regenerative, Granulated Activated Carbon
Partners: Penn State University, Cincinnati Water Works
- Carbon Fibers
Partners: Mer Corporation



Transfer NETL Supported Research and Development

Other DOE/Governmental Agencies:

- Regional Clean Water Initiatives
Partners: NETL, EPA, Office of Surface Mining, State EPAs, others
- Hydrogen Workshop
Partners: NETL, DOE's Office of Energy Efficiency, Industry, Others
- Rails to Trails
Partners: NETL, National and Regional Rails to Trails Associations, Pa. DEP, Industry, Others



Transfer NETL Supported Research and Development

Private Sector:

- Bio Off-Gas Utilization

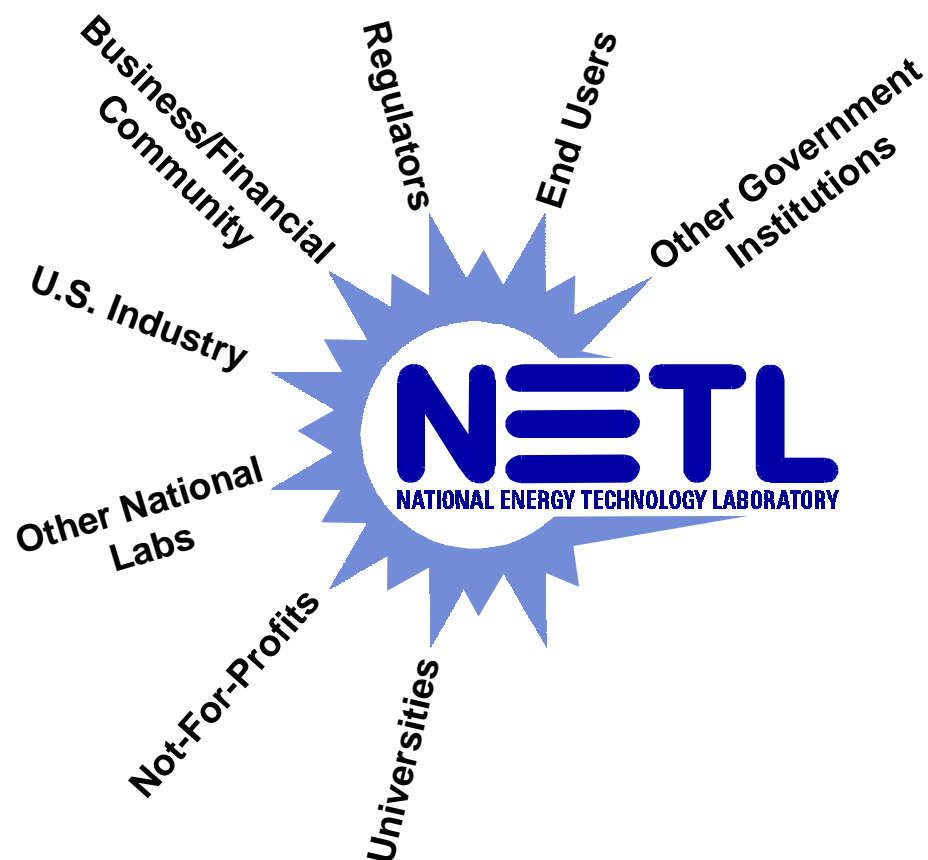
Partners: NETL, Pleasant Hills Municipal Authority, CMU, Gas and Electric Utilities, Pa. DEP, Engineering Firms

- Collaborations

Partners: PA and WV Technology Councils, HCC-WPA, AACCCWPA, Rails to Trail Associations, Pittsburgh River Life Task Force, Pittsburgh Regional Alliance, Others



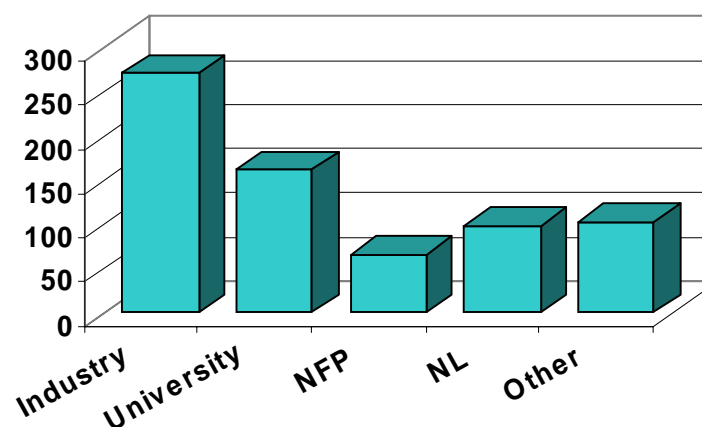
Partnerships Are a Key Strategy



Crucial to Success

- **Industrial partners perform 100% of commercialization**
 - Cost-sharing leverages DOE's RD&D dollars and ensures relevance
- **Ensures best resources used**

Projects by Partner Group



Visit Our Website

www.netl.doe.gov

We are now the

NETL

National Energy
Technology Laboratory

July 28, 2000

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NATIONAL ENERGY TECHNOLOGY LABORATORY

U.S. DEPARTMENT OF ENERGY - OFFICE OF FOSSIL ENERGY

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TOP NEWS STORIES

Energy Department Launches 13 New Research Projects to Capture and Store Greenhouse Gases

The innovative ideas of 13 private sector research teams for affordable ways to capture and store the gases that cause the "greenhouse effect" have been judged the best of more than 60 concepts submitted to the U.S. Department of Energy. [Read More!](#)



Vision 21 Roadmapping Workshop

The U.S. DOE National Energy Technology Laboratory (NETL) will hold a workshop on August 30-31, 2000 to develop technology roadmaps for Vision 21. [Read More!](#)

RECENT HEADLINES

- [From Biomass to Biotechniques - DOE Looks to Improve Power Plants](#)
- [NETL Website Wins APEX2000 Award for Excellence](#)
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Formerly
known as FETC

FEATURES



[Strategic Center
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[Vision 21](#)

